INTERCONNECTION OF DATA TERMINAL EQUIPMENT WITH A COMMUNICATIONS CHANNEL

(From EIA Standards Proposals No. 625 and 576 formulated under the cognizance of the EIA Engineering Subcommittee TR-24.3 on Data Transmission Equipment and approval by the TR-24 Committee on Automation Systems)

1. PURPOSE AND SCOPE OF COVERAGE

1.1 This standard is intended to provide a method of interconnecting data terminal equipment and a data communication channel when each is furnished by different companies. It defines a means of exchanging control signals and binary serialized data signals between data terminal equipment and a data communication channel in cases where interchange point is as shown in Figure 1.

1.2 The data communication channel includes transmitting and receiving signal converters to permit the data communication channel to exchange standardized signals with the data terminal equipment. These standardized signals are defined in Section 4.

1.3 The data are to be serialized by the data terminal equipment so that the design of the data communication channel may be independent of the character length and code used by the data terminal equipment.

1.4 It is intended that the signal interchange shall be located on the customer's premises and that the interchange circuits shall convey signals over relatively short distances (i.e., less than fifty feet).

1.5 Performance standards herein are not specified for the data communication channel or its associated equipment, either for maximum distortion of the received signals, transmission error rates, or interruptions of normal service. If the performance requirements of the complete system are more stringent than the expected performance of the data communication channel, the data terminal equipment may include error checking arrangements.

1.6 This standard neither requires nor prohibits pulse regeneration equipment associated with the data communication channel.

1.7 This standard is intended for modulation rates above 100 bands.

1.8 The control circuits at the signal interchange are arranged to permit the alternate use of a higher class of communication service, as follows:

(a) Data Terminal equipment designed for Send-Only Service may also use either Half-Duplex or Full-Duplex service.

(b) Data Terminal equipment designed for Receive-Only service may also use either Half-Duplex or Full-Duplex.

(c) Data Terminal equipment designed for Half-Duplex service may also use Full-Duplex service.

The substitution of a higher class of communication service does not require a change in the operation of the control circuits.

2. INTERCHANGE CIRCUITS

2.1 Seven interchange circuits are defined.

2.1.1 Frame Grounding Circuit. This conductor shall be electrically bonded to the machine frame and/or to any conducting parts which are normally exposed to operating personnel. This circuit may further be connected to external grounds as may be required by applicable Fire Underwriters Codes.

2.1.2 Signal Ground. This conductor establishes the electrical ground reference potential for all interchange circuits except the Frame Grounding Circuit.

2.1.3 Transmitted Data Circuit. Signals on this circuit are originated by the data terminal equipment for transmission on the data communication channel. This circuit is not required for Receive-Only Service.

2.1.4 Received Data Circuit. Signals on this circuit are originated by the receiving signal converter, in response to signals received over the communication media. This circuit is not required for Send-Only service.

In Half-Duplex service, the receiving signal converter shall hold marking condition on the Received Data Circuit when the remote data terminal equipment has its Send Request circuit in the off condition. (See paragraph 4.10.4) Optionally, in Half-Duplex service, the Received Data Circuit may be used to monitor transmitted signals (e.g., for local copy)

2.1.5 Send Request Circuit. Signals on this circuit are originated in the data terminal equipment to select whether the signal converter is to be conditioned to transmit or to receive. For Half-Duplex Service, when the signal on the Send Request Circuit is switched to the "on" condition, the signal converter shall switch to the transmit condition, without regard to any signals that may be received from the communication facility. When this signal is switched to the "off" condition, the signal converter shall switch to the receive condition, without regard to any signals on the Transmitted Data Circuit.

Data terminal equipment intended for use with Send-Only Service shall hold the Send Request Circuit in the "on" condition at all times. Data terminal equipment intended for use with Receive-Only Service shall hold the Send Request Circuit in the "off" condition at all times. This circuit is not required for Full-Duplex Service.

2.1.6 Clear-to-Send Circuit. Signals on this circuit are originated in the signal converter. For Send-Only and Full-Duplex Service, the signal converter shall hold the Clear-to-Send Circuit in the "on" condition at all times. This circuit is not required for Receive-Only Service.

For Half-Duplex Service, when the Send Request signal is switched to the "on" condition, the Clear-to-Send Circuit shall be switched to the "on" condition after a time delay sufficient to effect the reversal of direction of transmission of the data communication channel and all associated equipment. When the Send Request Circuit is switched back to the "off" condition, the Clear-to-Send Circuit shall be switched back to the "off" condition.

2.1.7 Interlock Circuits. The signal on this circuit originates in the signal converter and shall be in the "on" condition only when all the following conditions are met:

(a) That its internal switching circuits are arranged for signalling on a communication facility

(b) That it is not in any abnormal or test condition which disables or impairs any normal function associated with the class of service being used.

2.2 Additional interchange circuits may be provided to perform special functions, such as to convey timing information or to notify the data terminal equipment that the data communication channal is not in use. Such additional circuits shall conform to the electrical specifications in Section 4.

3. LINE OF DEMARCATION

3.1 The interchange point shall be a pluggable connector. The female connector shall be associated with the data communication channel and should be mounted in a fixed position near the data terminal equipment. An extension cable with a male connector shall be provided with the data terminal equipment. The total length of cable between the data terminal equipment and the data communication equipment should be short (less than approximately 50 ft.--see sections 1.2 and 4.7).

4. ELECTRICAL SIGNAL CHARACTERISTICS AND WIRING

4.1 All interchange circuit equipment shall conform to the National Electrical code (note 1) and Underwriters Laboratory Standards (note 2).

4.2 The wiring of interchange circuits shall be such that no circuit except the Frame Grounding Circuit is directly exposed to contact by operating personnel.

4.3 The maximum open-circuit voltage to ground (either Frame Ground or Signal Ground) on any interchange circuit shall not exceed 50 volts, and the maximum short-circuit current flow between any two conductors (including grounds) shall not exceed one-half ampere.

4.4 Any circuitry used to generate a signal voltage on an interchange circuit shall be so designed that no damage will be caused by either an open circuit condition or a short circuit to either Frame Ground or Signal Ground. Any circuitry used to receive signals from an interchange circuit shall be designed for continuous operation with any input signal within the maximum voltage limits specified in Section 4.3.

4.5 The signal on an interchange circuit shall be considered in the "marking" or "off" condition when the voltage on the circuit is more negative than minus three volts with respect to Signal Ground, and the signal shall be considered in the "spacing" or "on" condition when the voltage is more positive than plus three volts with respect to Signal Ground. The "marking" and "spacing" terminology will be used for the Transmitted Data Circuit and Received Data Circuit, while the "off" or "on" terminology will be used for all other circuits.

4.6 The operation of the circuitry that receives signals from an interchange circuit shall be dependent only on the signal voltage, as specified in Section 4.5, and should, therefore, be insensitive to the rise time, fall time, presence of signal overshoot, etc. The design of this circuitry shall minimize the effects of any circuit time constants which would delay the circuit response, thus introducing time distortion in the signals.

4.7 The terminating impedance of the receiving end of an interchange circuit shall have a d.-c. resistance of not less than 1000 ohms, and the voltage in open-circuited condition shall not exceed two volts. The effective shunt capacitance of the receiving end of a signal interchange circuit, measured at the pluggable connector, shall not exceed 2500 micromicrofarads.

4.8 The source impedance of the sending end of an interchange circuit is not specified.

4.9 For the Transmitted Data Circuit and Received Data Circuit, neither the rise nor the fall time through the 6 volt range in which the signal condition is not defined, shall exceed three per cent of the nominal pulse period. The circuitry used to generate a signal voltage on a interchange circuit shall meet this specification with any receiving termination which complies with Section 4.7.

4.10 The following are offered as a guide in the equipment design to obtain reliable operation and ease of maintenance with minimum timing distortion, introduced by the interchange circuits:

(1) The signal voltage on all interchange circuits should be at least ± 3 volts with respect to Signal Ground (referred to in paragraph 4.5) and not greater than ± 20 volts with respect to Signal Ground.

(2) The signals should have approximately rectangular waveforms.

(3) In order to avoid inducing voltage surges on interchange circuits, signals from interchange circuits should not be used to drive inductive devices, such as relay coils. (Note that relay or switching contacts may be used to generate signals on an interchange circuit.)

Note 1: National Electrical Code for Class 2 Remote Control and Signalling Systems, as defined in Article 727 of the National Electrical Code, Volume V of the National Fire Codes, 1956 edition.

Note 2: Underwriters Laboratories Standard for Power Operated Radio Receiving Appliances (adopted by the American Standards Assoc. C65.1).

(4) It should be noted that on some types of communications channels it may not be economically feasible to provide a "mark hold" specification as indicated in paragraph 2.1.4. It may therefore be desirable for operation of the data terminal equipment to be independent of this specification for "mark hold."

5. GLOSSARY OF TERMS

5.1 Classes of Communication Service. The interchange circuits are defined for four classes of communication service:

Half-Duplex Service, in which the data communication channel is capable of transmitting and receiving signals, but is not equipped for simultaneous and independent transmission and reception.

Send-Only Service, in which the data communication channel is capable of transmitting signals, but is not equipped to receive signals.

Receive-Only Service, in which the data communication channel is capable of receiving signals, but is not equipped to transmit signals.

Full-Duplex Service, in which the data communication channel is capable of simultaneous and independent transmission and reception.

5.2 Definitions

Pulse Regeneration is the process of restoring a series of pulses to the original timing, form and relative magnitude.